3. Development of Counter-Rotating Vortex Pair in a Crossflow Jet

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Figure 1(a) α=10˚

Figure 1(b) α=30˚

Figure 1(c) α=50˚

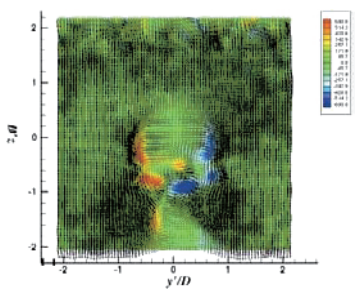

Figure 2(a) α=10˚

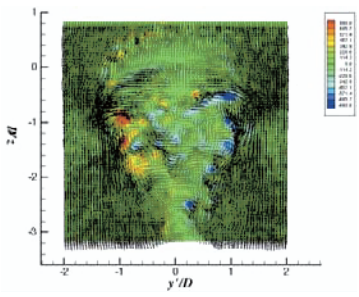

Figure 2(b) α=30˚

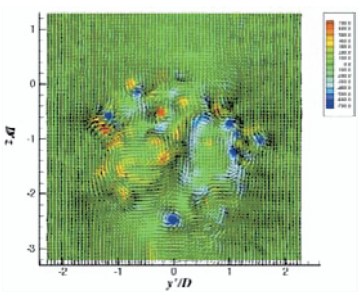

Figure 2(c) α=50˚

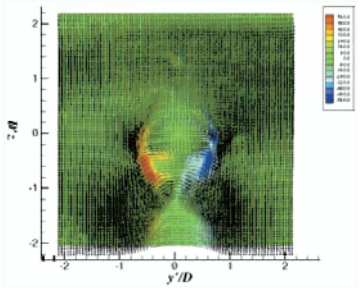

Figure 3(a) α=10˚

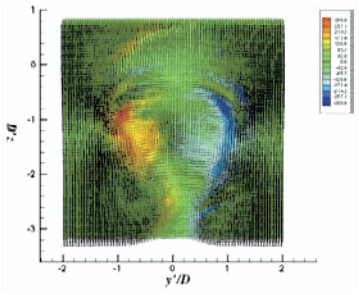

Figure 3(b) α=30˚

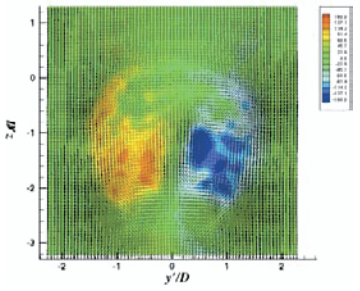

Figure 3(c) α=50˚

The development of counter-rotating vortex pair (CVP) in a crossflow jet was studied experimentally. The jet-to-crossflow velocity ratio was set to be 3.3 and the Reynolds number based on the crossflow velocity and jet diameter was 1,050. The instantaneous laser tomographic images (Figure 1) and velocity fields (Figure 2) were obtained along the crossflow jet at various transverse planes with the angle α between the trajectory coordinate and the wind tunnel bottom plate. Ensemble averaged velocity fields depicted in Figure 3 clearly show the development of the CVP. It is found that the CVP was initiated from the hanging vortices appeared at both lateral sides of the jet column. Note that there are many streamwise vortical streaks in the instantaneous fields which might be created by vortex breakdown process and the rotation of shear layer vortices.

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